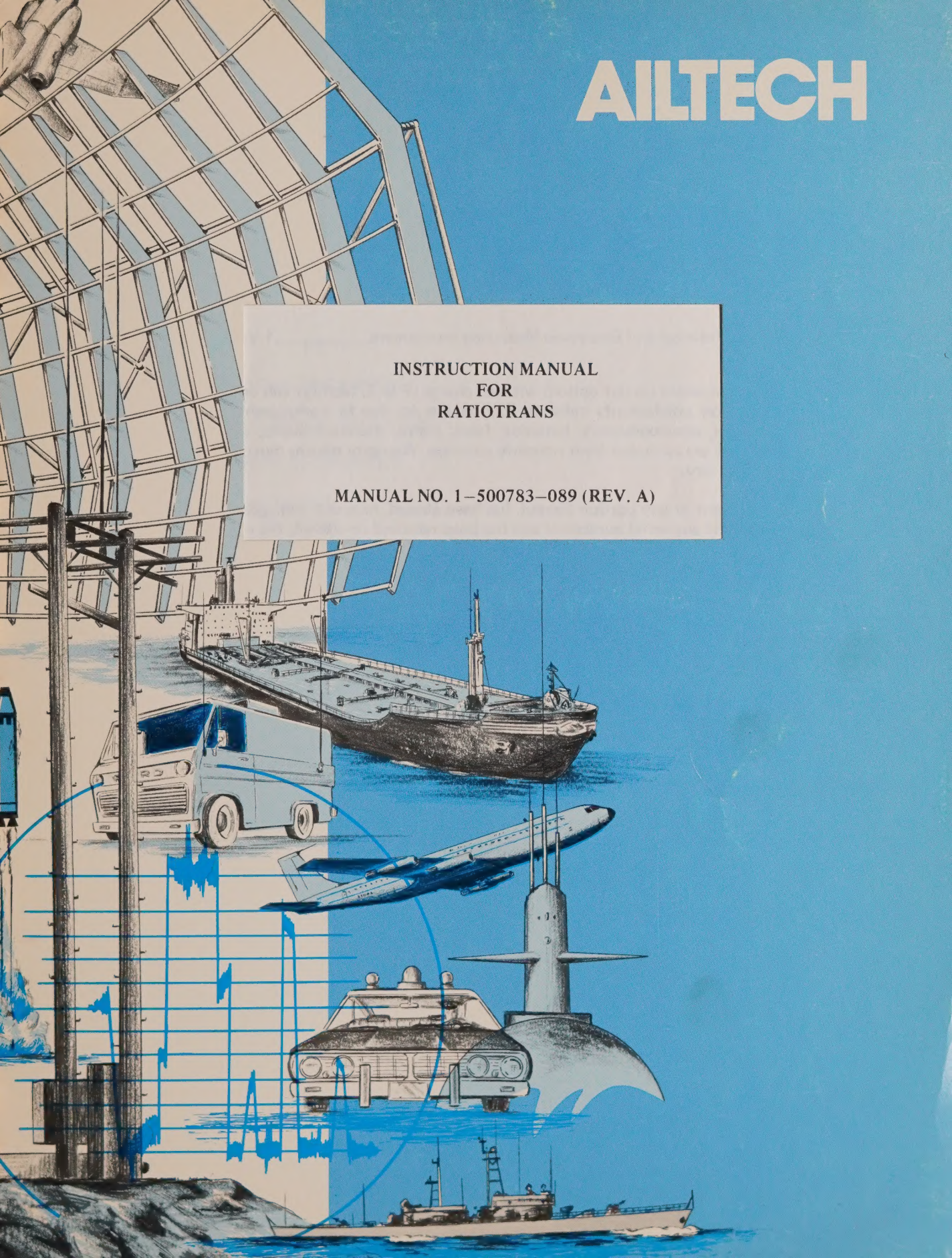


AILTECH

INSTRUCTION MANUAL
FOR
RATIOTRANS

MANUAL NO. 1-500783-089 (REV. A)





**INSTRUCTION MANUAL
FOR
RATIOTRANS**

MANUAL NO. 1-500783-089 (REV. A)

Reprinted 1/81—Libra

**Eaton Corporation
Electronic Instrumentation Division
Los Angeles Plant
5340 Alla Road
Los Angeles, California 90066**

WARRANTY

Eaton Corporation, Electronic Instrumentation Division, Los Angeles Plant, (SELLER) warrants each new instrument to be free from defects in material and workmanship, effective after delivery to the original purchaser as follows:

Electrical and Electronic Measuring Instruments 1 Year

Repair or replacement (at our option) without charge (F.O.B. factory) will be effected when our examination satisfactorily indicates that defects are due to workmanship or materials. Electron tubes, semiconductors, batteries, fuses, lamps, thermoelements, and Ratio Tran potentiometers are excluded from warranty coverage. Warranty returns must first be authorized by the factory.

If the instrument or any portion thereof, has been abused, misused, damaged by accident or negligence, or if any serial number or seal has been removed or altered, the warranty is void.

This warranty is in lieu of all other warranties, express or implied INCLUDING THE IMPLIED WARRANTY OF MERCHANTABILITY, or fitness for a particular purpose. In no event shall the SELLER be liable for INCIDENTAL OR CONSEQUENTIAL damages. The SELLER neither assumes, nor authorizes any person to assume for it, any other liability in connection with sales of instruments manufactured by SELLER.

With respect to repairs, the foregoing warranty shall apply for a period of ninety days to the repaired portion.

Eaton Corporation,
Electronic Instrumentation Division, Los Angeles Plant
5340 Alla Road, Los Angeles, California 90066

REPAIR AND MAINTENANCE

Instruments should be returned only on prior authorization from the Representative or the factory. You will be advised of detailed shipping instructions at that time. Return the instrument to the factory Prepaid. Validity of warranty will be determined by the factory.

Chargeable repairs: If requested, an estimate of charges will be made prior to repairs. Please provide us with the following information in order to expedite the processing of your instrument:

- | | |
|---|--|
| 1. Model or Type | 5. Approximate number of hours in use. |
| 2. Serial Number | 6. Maintenance action previously requested or performed. |
| 3. Description of trouble ⁽¹⁾ | 7. Other comments. |
| 4. Approximate date instrument was placed in operation. | |

⁽¹⁾ Include data on symptoms, measurements taken, suspected location of trouble, maintenance action taken and any other relevant data.

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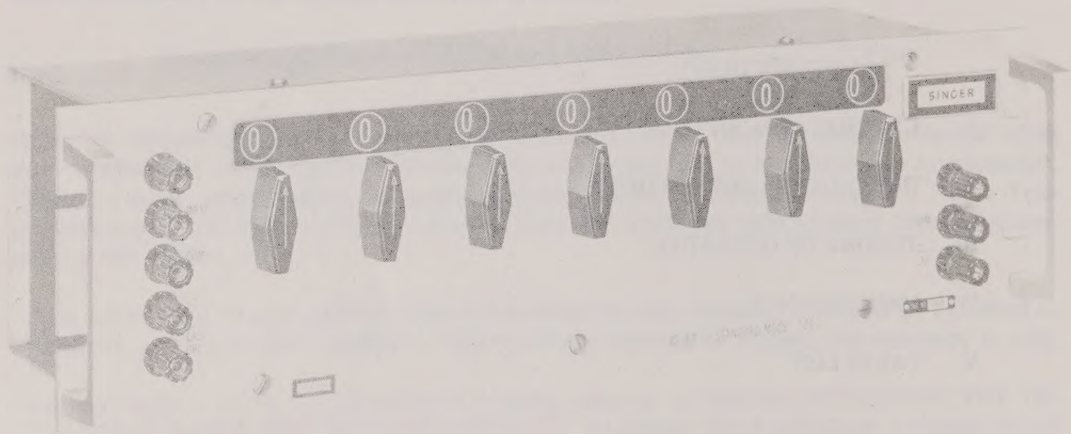


FIGURE 1. MODEL 1011 AC RATIO STANDARD

RATIOTRAN CALIBRATION

The Singer Company, Los Angeles Operation, has in its Standards Laboratory a Model 1011 AC Ratio Standard which has been calibrated by the National Bureau of Standards, Washington, D.C.

As a result, any RatioTran or precision transformer may be supplied with certification traceable to the National Bureau of Standards. Contact the factory for additional information.

SECTION I

GENERAL DESCRIPTION

This instruction book contains information on Standard Ratio Transformers (RatioTran) in sufficient detail to permit the operation and maintenance that may be encountered.

Due to the large number of models of RatioTran available, this instruction book is by necessity restricted to standard catalog items. The general RatioTran theory is, however, applicable to any model.

THE DESIGN AND MANUFACTURE OF THE GERTSCH RATIOTRAN IS COVERED BY U. S. PATENT NO. RE. 24,896.

The RatioTran is a precision Inductive Voltage Divider consisting of a tapped toroidal autotransformer. Switching is provided for tap selection so that the transformation ratio of input to output may be conveniently set. The switching may be push button or rotary as in standard units or stepping switches and relays as in special programmable units.

REFERENCE IS MADE TO OUR GENERAL RATIOTRAN CATALOG AND SHORT FORM CATALOG FOR COMPLETE SPECIFICATIONS AND DESCRIPTIVE MATERIAL ON THE STANDARD LINE OF RATIOTRANS.

The inductive voltage divider of RatioTran has several characteristics which offer distinct advantages over resistive type units for AC voltage division. They are as follows:

1. Higher Ratio Accuracy: Ratio accuracies of standard catalog units in the Gertsch line range from .001% to .0001% depending upon model.
2. Stability: The ratio accuracy of the RatioTran is based upon the use of a toroidal autotransformer which is not affected by age or environmental conditions.
3. Low Series Impedance: When driven by a constant voltage source the internal impedance of the RatioTran is low, ranging from 2 to 5 ohms. Units designed to simulate rotating components (Synchro and Resolver Standards) offer an effective series impedance as low as .01 ohm.
4. Low Phase Shift: The phase error in the output of the RatioTran is a function of frequency and ratio but is nominally .003°. See figure 4 for typical phase characteristics.

For purposes of a general description the standard line of units may be classified into the following groups:

1. High Frequency, Low Voltage type.
2. Low Frequency, High Voltage type.
3. AC Ratio Standards.
4. MIL SPEC Units.
5. Programmable RatioTran.

HIGH FREQUENCY LOW VOLTAGE RATIOTRANS

The standard units in this category are designated by the following Model Numbers: RT-1, 2, 5, 6, 7, 10R, 11R, 12R, 13R, 18, 20R, 22R & 60. CRT-1, 2, 11, & 12.

All the above have in common an input voltage limitation of $.35xf$ (f in cps) to a maximum of 350V rms and a recommended operating frequency range of 50 - 10,000 cps. The input voltage restriction is determined by the excitation level causing core saturation as is explained in Sec. III, Theory of Operation. The input limit of $.35xf$ permits the application of up to 140V rms at 400 cps.

In addition to the common input voltage limitation and frequency range the RatioTran in The High Frequency, Low Voltage category also have similar input impedance characteristics.

The input inductance of these units is approximately 150 Henries; however due to stray winding capacity, a parallel resonant effect occurs at approximately 400 cps. Figure 2 is an input impedance curve for a typical RatioTran in this group. Referring to figure 2, note that the input impedance is typical of a parallel resonant LC circuit tuned to approximately 400 cps.

The phase angle of the input impedance will, of course, be inductive at frequencies below resonance and capacitive at frequencies above resonance. The phase angle of the input impedance should not be confused with phase error of the RatioTran. The fact that the input impedance may have a phase angle at frequencies off resonance will not result in phase shift through the transformer.

LOW FREQUENCY, HIGH VOLTAGE RATIOTRANS

The units in this group are characterized by the following:

1. Input Voltage Limitation of $2.5xf$ (f in cps) to a maximum of 350V or 1000V.
2. Recommended operating frequency range of 30 - 1000 cps.

The RatioTran in this category are designated by the following Model Numbers:

RT-3, 4, 8, 9, 61 (Max of 350V input)
RT-14, 15 (Max. of 1000V input)

The input inductance of these models is approximately 500 Henries. As in the case of the units described previously the stray capacity of the windings causes a self-resonant effect. The frequency of resonance is considerably lower, being approximately 60 cps for the 350V units and approximately 200 cps for the 1000V units. Figure 3 indicates the open circuit input impedance of the RatioTran in this group. Once again it should be emphasized that the varying impedance level and impedance phase angle do not in any way introduce ratio errors in the RatioTran.

AC RATIO STANDARDS

A third and most significant group of RatioTrans is the Model 1000 Series of Ratio Standards. Due to recent advances in metallurgy there is now available core material with permeabilities far higher than was originally employed in the standard line of RatioTrans previously discussed. This improved material plus special winding techniques have resulted in the ability to produce ratio transformers with ratio accuracies of up to .0001% or 1 part per million. (The effect of core permeability is discussed in detail in Section III, Theory of Operation).

The Model 1000 Series of Ratio Standards includes High Frequency, Low Voltage units, Low Frequency, High Voltage units, and Kelvin-Varley Resistive Dividers for DC applications independently or in combinations. The following details the models available in this series:

Model 1000	.35f and 2.5f units
Model 1001	.35f and DC units
Model 1002	2.5f and DC units
Model 1003	.35f unit
Model 1004	2.5f unit
Model 1005	DC unit
Model 1009	.35f and 2.5f units (7 decade)
Model 1010AR	.35f unit (7 decade)
Model 1011R	.35f unit (7 decade)
Model RT-19	.35f unit (7 decade)

Complete specifications for the Model 1000 Series are available upon request.

MIL SPEC UNITS

For applications requiring performance under severe environmental conditions a series of RatioTrans are available which have been tested to the following specifications:

Shock	Mil-S-901B (5 ft. drop, 400 lb. hammer)
Salt Spray	Mil-E-5272A
Drip Proof	Mil-STD-108
Vibration:	
Operating	Mil-STD-167, Type I
Non-operating	Mil-E-4970, Proc. III
Sand and Dust	Mil-E-4970, Proc. I
Altitude	Mil-E-4970, Proc. I

Explosion	Mil-E-4970, Proc. I
Fungus	Mil-E-5272
Humidity	Mil-STD-202A
High Temp.	
Operating	+ 52° C
Non-operating	+ 71° C
Low Temp.	
Operating	- 18° C
Non-operating	- 54° C
Dielectric Strength	900 V RMS, 60 cps

The above tests were performed by an independent testing laboratory.

All of the units designed for MIL SPEC application are of the coaxial switch design and are designated as CRT-3, 4, 5, & 6. These units are all characterized by an input voltage rating of .35 x f (f in cps) to a maximum of 350V rms. The recommended frequency range is 50 - 10,000 cps.

PROGRAMMABLE RATIOTRANS

A series of RatioTrans are available which may be remotely programmed by punched tape, magnetic tape, IBM card, etc., to serve as an analog converter. Items in this category are difficult to consider a "standard catalog" due to the fact that specific system applications generally dictate the design. Representative programmable units are shown in The General RatioTran Catalog.

Included in this group are Binary Coded Decimal and Straight Binary types. Ratio Selection is by means of special gold contact relays or stepping switches.

SPECIAL PURPOSE TRANSFORMERS

In addition to the line of RatioTrans, a number of special purpose transformers are available to increase the flexibility of the Ratio Transformer in special circuits. These special purpose transformers include:

1. ST-100 Series, bridge transformers.
2. ST-200 Series, phase inverting transformers.
3. ST-248 Series, isolation transformers.

Reference is made to the RatioTran catalog and Short Form Catalog for complete specifications on these units. Units in this series have been qualified to Mil-T-27A.

SECTION II

OPERATION & APPLICATION

Operation of a Standard RatioTran requires no additional information other than that found on the name plate.

The input voltage rating (.35 x f or 2.5 x f, f in cps) must be observed in order to prevent core saturation. The affects of saturation are explained in Section III, Theory

of Operation.

The RatioTran has found wide application in many fields of instrumentation. The most basic application is for use in a ratio arm bridge for the measurement of voltage ratios. Any measurement requiring precise AC voltage division will be improved by the use of the RatioTran.

SECTION III

THEORY OF OPERATION

THEORETICAL ANALYSIS OF ACCURACY

Theoretical analysis of a perfect autotransformer used for stepdown purposes shows that if leakage inductances and winding resistance are uniformly distributed and the turns can be accurately tapped, the accuracy as a voltage divider for no load is perfect.

Consider first the effects of leakage inductance. The most symmetrical configuration insofar as flux is concerned is the uniformly wound toroid. By suitably interleaving the windings and carefully maintaining uniformity, the total leakage inductances can be kept to under 10% of the air core inductance. Since the air core inductance is approximately $1/u$ times the inductance with iron core, where u is the permeability of the core material, the total leakage inductance to coupled inductance ratio is $1/10u$. The core material used in the transformers is supermalloy which has a guaranteed initial permeability of 55,000. The initial permeability for core material in the Model 1000 Series is 100,000. The leakage to coupled inductance ratio is therefore approximately .0002% to .0001%. Since this figure represents the ratio of voltage dropped in the leakage inductance to total voltage, the error in the transformer due to non-distributed leakage inductance will not exceed this, if the leakage inductance per turn does not vary by more than $\pm 100\%$. This condition can be met with suitable techniques of interleaving the windings.

Non-distributed winding resistance has much the same effect as non-distributed leakage inductance. If the effects of winding capacities are neglected, the winding resistance is most important at low frequencies since the exciting impedance of the transformer is directly proportional to frequency. Since the exciting impedance is fairly reactive, the voltage dropped in the winding resistance will be almost in quadrature with the input and consequently any non-distributed resistance will cause some phase error as well as magnitude error. The fact that this error voltage is in quadrature makes the magnitude error extremely small and for all practical purposes negligible. Typical figures might be .000001% for small ratios and even less for larger ratios. Phase angles from this cause would be approximately .01 milliradians at low frequencies and small ratios decreasing for larger ratios.

A typical curve of phase shift as a function of ratio is shown in Figure 4.

At higher frequencies distributed capacitance becomes important. It causes voltage drops in the leakage inductance and winding resistance which are not uniformly distributed due to the transformer action. Like the effects of winding resistance, the errors caused by the capacitance are mainly in quadrature and so cause phase shift at low ratios. Typical values for this phase shift are:

Less than .05 milliradians for frequencies below 1 KC

and ratios above .1 for low voltage — high frequency units.

Less than .05 milliradians for frequencies below 200 cps and ratios above .1 for high voltage low frequency units.

Phase angle due to this cause is almost directly proportional to frequency for any particular ratio down to frequencies where the non-distributed resistance takes over.

Other sources of error are:

1. Voltage drops due to exciting current in the leads to the transformer.
2. Loading effects of the potentiometer.
3. Non-linearity and end effects of the potentiometer.

The first of these effects may be minimized by using heavy connecting leads or treating the transformer as a four terminal impedance. The internal wiring of the transformers contributes to this error. These effects are worse at higher frequencies, above the self-resonant frequencies of the transformers.

The potentiometers cause some loading effects on the transformers due to the internal impedance of the windings and switch contacts.

For units with the 10 turn potentiometer, such as the RT-1 and Model RT-10, the errors due to this cause are approximately .0001% of the input. In the single turn units this error amounts to about .00001%. The single turn potentiometer causes less error than the 10 turn since the voltage across it is .001% of the input in comparison to .1% across the 10 turn potentiometer.

Non-linearity and end effects of the potentiometer may cause an error of approximately .005% of the input in the case of the units with the 10 turn potentiometers. The single turn potentiometers may cause an error of .00001% of the input.

From the foregoing consideration a reasonable terminal linearity figure of .001% is derived. The usual definition of terminal linearity is the error in the output divided by the total input:

$$\text{Terminal Linearity} = \frac{\Delta E_o}{E_{IN}} \quad \text{where } \Delta E_o \text{ is the actual error voltage in the output and } E_{IN} \text{ is the total input voltage.}$$

An accuracy figure in terms of the output voltage would be

$$\text{Ratio Accuracy} = \frac{\Delta E_o}{E_o}$$

where ΔE_o is the actual error voltage in the output and E_o is the total output voltage.

When the ratio gets small, the error caused by pot loading, pot non-linearity, and lead drops become predominant. Since these errors are constant in absolute value, their fractional value in terms of the output is inversely proportional to the ratio of the transformer. Taking this into account a reasonable ratio accuracy for the three decade units with the 10 turn pot is:

$$\text{Ratio Accuracy} \pm \frac{(.001\% + .0006\%)}{\text{Ratio}}$$

(This applies to Models RT-1 & 10) For the decade units, with or without the single turn pot:

$$\text{Ratio Accuracy} \pm \frac{(.001\% + .0001\%)}{\text{Ratio}}$$

(This applies to all Models except RT-1 & 10).

Standards suitable for certifying transformers to the accuracy figures quoted are not generally available. It can be seen, however, from the foregoing discussions that the transformers are inherently excellent voltage dividers. They can be considered primary standards of ratio in that one can be constructed by following assembly instructions and requiring no measurements or calibrations other than wiring checks and tests to make certain that the number of turns is correct. A unit so constructed will match any other unit so constructed to well within the specifications quoted above. The units are ageless, requiring no calibration tests and should perform indefinitely with no loss in accuracy barring some switch failure or actual damage to the transformer.

THE EFFECTS OF EXCESSIVE INPUT VOLTAGE

The above applies for operation of the RatioTran within its voltage rating of .35 x f or 2.5 x f, f in cps.

Input voltage in excess of rating will cause core saturation, resulting in the permeability of the core material to drop sharply to almost zero. The input impedance will drop correspondingly, resulting in excess input current. If driven by a low impedance source the input fuse in units

so supplied will blow, thereby protecting the transformer windings. No adverse effects result from saturation once the input voltage is reduced to within rating.

The application of DC to the RatioTran will cause saturation if DC currents of more than a few microamperes are allowed to flow through the input winding.

If DC is accidentally applied to the RatioTran, the unit should be degaussed to restore full performance characteristics. The procedure is as follows:

A. .35f Units.

1. Connect a 1000 ohm resistor in series with the *input* terminal.
2. By means of a Variac or other suitable control, apply a 60 cps signal between the open end of the 1000 ohm resistor and RatioTran common.
3. Starting with the Variac at zero, increase the Variac output to 40V rms.
4. Decrease the Variac output slowly to zero. The period of time taken to reduce the voltage from 40V to zero should be 10 to 15 seconds.

B. 2.5f Units.

1. Set the RatioTran to an indicated ratio of .100 000.
2. Connect a 1000 ohm resistor in series with the *output* terminal.
3. By means of a Variac or other suitable control, apply a 60 cps signal between the open end of the 1000 ohm resistor and Ratio-Tran common.
4. Starting with the Variac at zero, increase the variac output to 30V rms.
5. Decrease the Variac output slowly to zero. The period of time to reduce the voltage from 30V to zero should be 10 to 15 seconds.

SECTION IV MAINTENANCE

The RatioTran, being a passive device, is inherently trouble free, requiring a minimum of periodic maintenance. It is recommended that switch contacts be periodically inspected and cleaned for optimum performance.

The following parts lists are valid for RatioTrans now

in production. Spare parts for units produced prior to July 1, 1961, are available from the factory. When requesting spare parts include the Model Number and Serial Number of the unit. The serial number is of particular importance, since parts complements have changed for given models as the product line is improved.

SECTION V PARTS LIST

REPLACEMENT PARTS FOR RATIOTRANS RT SERIES

Model No.	Switch Part No.	No. Required	Transformer Part No.	No. Required	Bussmann Fuse Part No.	No. Required	Potentiometer Part No.	No. Required
RT-1 RT-1R	SW-29	3	TA-6	1	MDL 1½ AGC ½	1 1	25-AZ	1
RT-2 RT-2R	SW-29	5	TA-3 TA-4	1 1	MDL 1½	2		0
RT-3 RT-3R	SW-29	5	TA-5 TA-4	1 1	MDL 1½	2		0
RT-4 RT-4R	SW-54	5	TA-7 TA-8	1 1	MDL 1½	2	RV-5	1
RT-5 RT-5R	SW-54	5	TA-2 TA-1	1 1	MDL 1½	2	RV-5	1
RT-6 RT-6R	SW-47	5	TA-9 TA-10	1 1	MDL 1½	4		0
RT-7 RT-7R	SW-47	5	TA-9 TA-10	1 1	MDL 1½	4	RV-5	1
RT-8 RT-8R	SW-47	5	TA-11 TA-12	1 1	MDL 1½	4		0
RT-9 RT-9R	SW-47	5	TA-11 TA-12	1 1	MDL 1½	4	RV-5	1
RT-10R	SW-54	3	TA-13	1	AGC ½	1	25-AZ	1
RT-11R	SW-47	5	TA-14 TA-15	1 1	MDL 1½	2	RV-5	1
RT-12R	SW-48	5	TA-231 TA-230	1 1	MDL 1½	2	RV-5	1
RT-13R	SW-47	5	TA-14 TA-15	1 1	MDL 1½	2		0
RT-14 RT-14R	SW-47	5	TA-86 TA-87	1 1	MDL 1½	4		0
RT-15 RT-15R	SW-47	5	TA-83 TA-86	1 1	MDL 1½	4	RV-32	1
RT-16 RT-16R	SW-47	5	TA-227 TA-228	1 1	MDL 1½	4	RV-32	1
RT-18 RT-18R	SW-53 SW-56	7 1	TA-135 TA-119	1 1	MDL 1½	2		0
RT-20R	SW-63 SW-53	1 4	TA-148 TA-2	1 1	MDL 1½	2	RV-5	1
RT-22R	SW-51	5	TA-295 TA-296	1 1	MDL 1½	2	RV-5	1
RT-60	SW-126	5	TA-249	1	MDL 1½	2		0
RT-61	SW-126	5	TA-267	1	MDL 1½	2		0

REPLACEMENT PARTS FOR RATIO STANDARDS

Model No.	Switch Part No.	No. Required	Transformer Part No.	No. Required	Bussmann Fuse Part No.	No. Required
1000 1000R	SW-49	6	TA-60-1 TA-61 TA-50 TA-51-1	1 1 1 1	MDL 1½ MDL 1½	2 4
1001R	SW-50	6	TA-51-2 TA-60-2	1 1	MDL 1½	1
1002 1002R	SW-50	6	TA-123 TA-92	1 1	MDL 1½	1
1003 1003R	SW-51	6	TA-51-3 TA-60-3	1 1	MDL 1½	1
1004 1004R	SW-51	6	TA-50 TA-61	1 1	MDL 1½	1
1005 1005R	SW-34	6		0		0
1009 1009R	SW-68 SW-70	6 1	TA-159 TA-160 TA-161 TA-162	1 1 1 1	MDL 1½	2
1010AR 1011R	SW-180 SW-181	6 1	TA-285 TA-286	1 1	MDL 1½	0 2
RT-19 RT-19R	SW-53 SW-63	6 1	TA-148 TA-149	1 1	MDL 1½	2

REPLACEMENT PARTS FOR COAXIAL RATIOTRANS CRT SERIES

Model No.	Switch Part No.	No. Required	Transformer Part No.	No. Reqd.	Potentiometer Part No.	No. Required	Bussmann Fuse Part No.	No. Required
CRT-1	SW-23	3	TA-40	1	A 25R Helipot	1	MDL 1½	2
CRT-2	SW-23	3	TA-40	1	RV-14	1	MDL 1½	2
CRT-2A	SW-88	3	TA-40	1	RV-25-3	1	MDL 1½	2
CRT-3	SW-25	3	TA-39-1	1	RV-17	1		0
CRT-4	SW-25	3	TA-39-2	1	510 Spectrol	1		0
CRT-5A	SW-25	2	TA-166	1	RV-37	1		0
CRT-6	SW-25	3	TA-39-1	1	RV-17	1		0
CRT-7	SW-91	3	TA-191	1	RV-25-2	1		0
CRT-11	SW-23	3	TA-134	1	A 25R Helipot	1	MDL 1½	2
CRT-12	SW-23	3	TA-134	1	RV-14	1	MDL 1½	2
CRT-12A	SW-88	3	TA-134	1	RV-25-3	1	MDL 1½	2

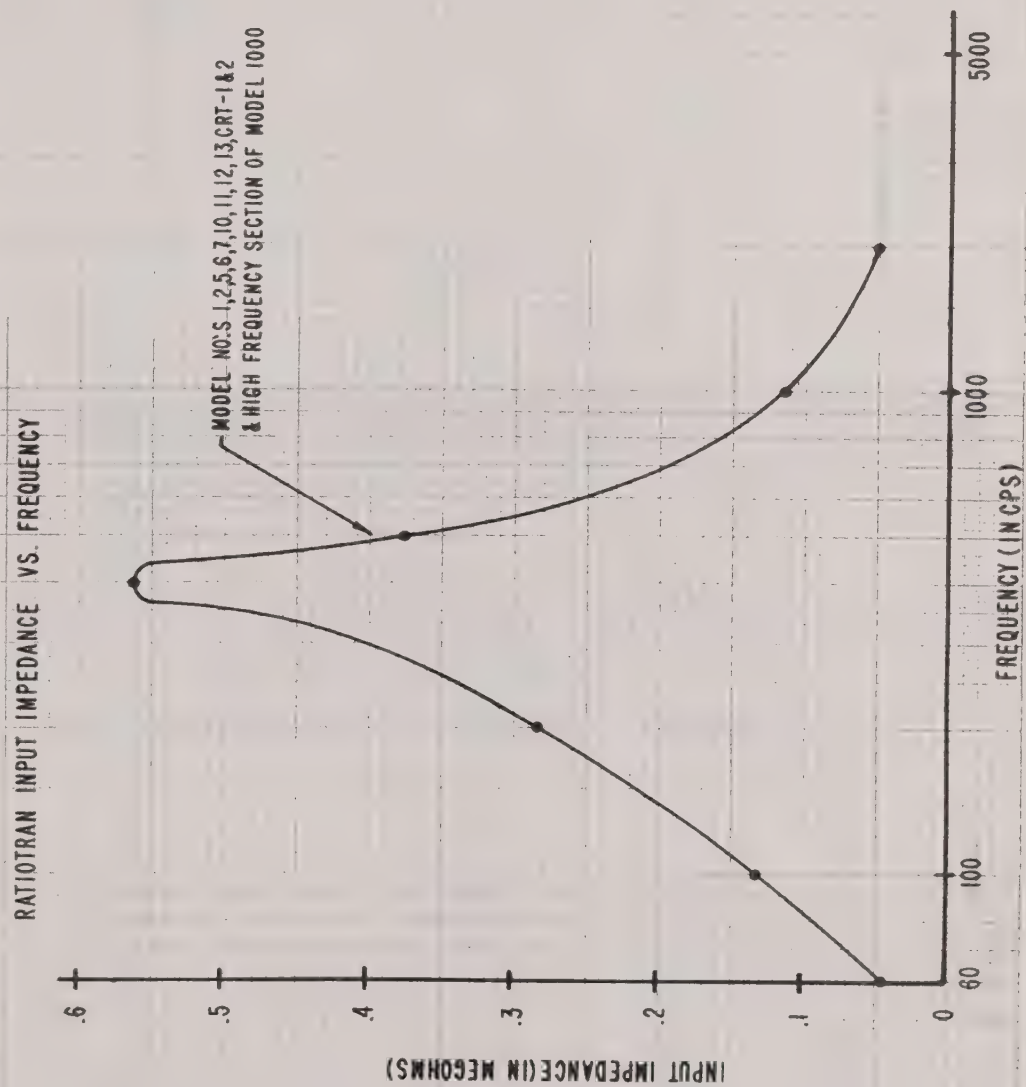


FIGURE 2. INPUT IMPEDANCE, .35f units

RATIOTRAN INPUT IMPEDANCE VS. FREQUENCY

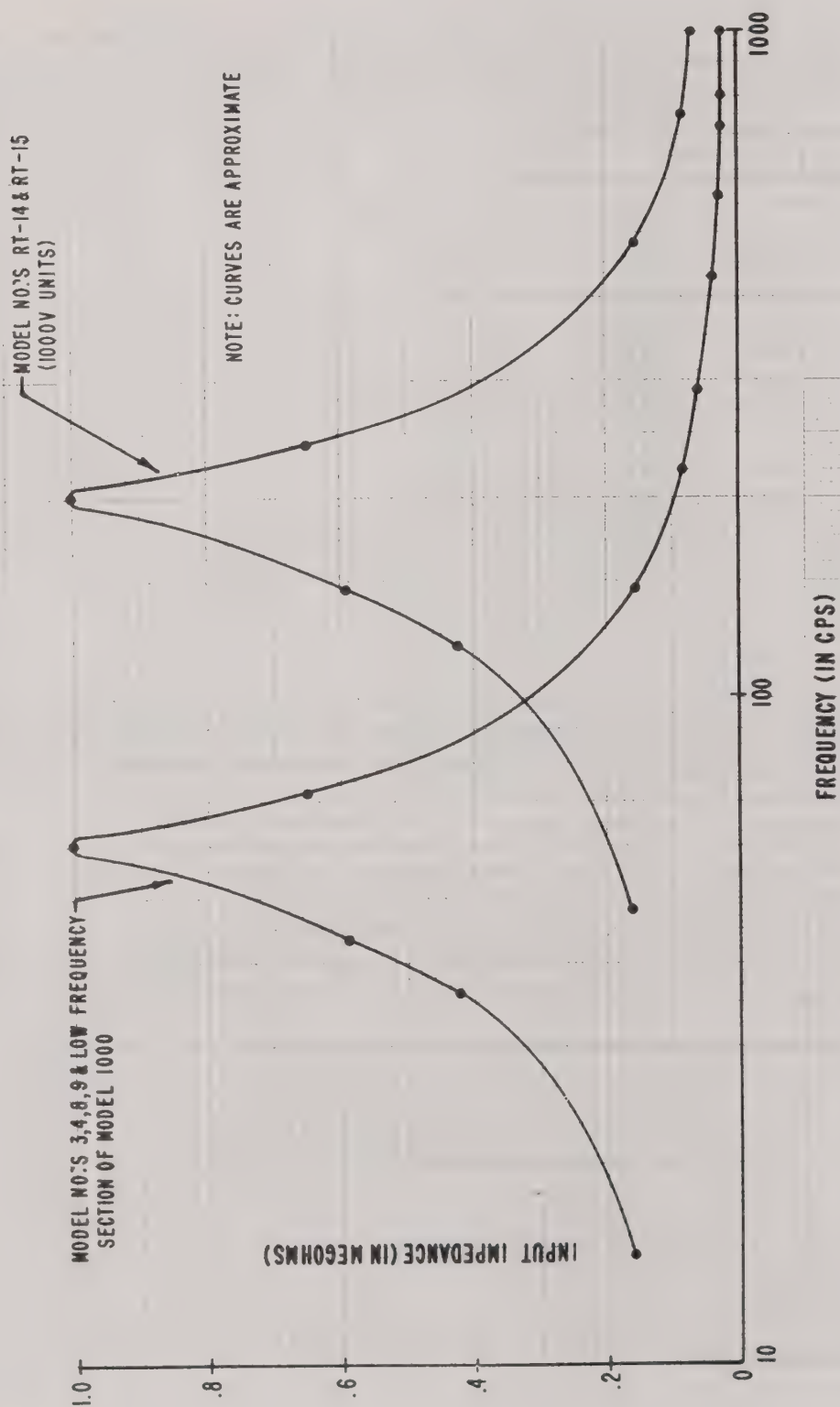


FIGURE 3. INPUT IMPEDANCE, 2.5f units

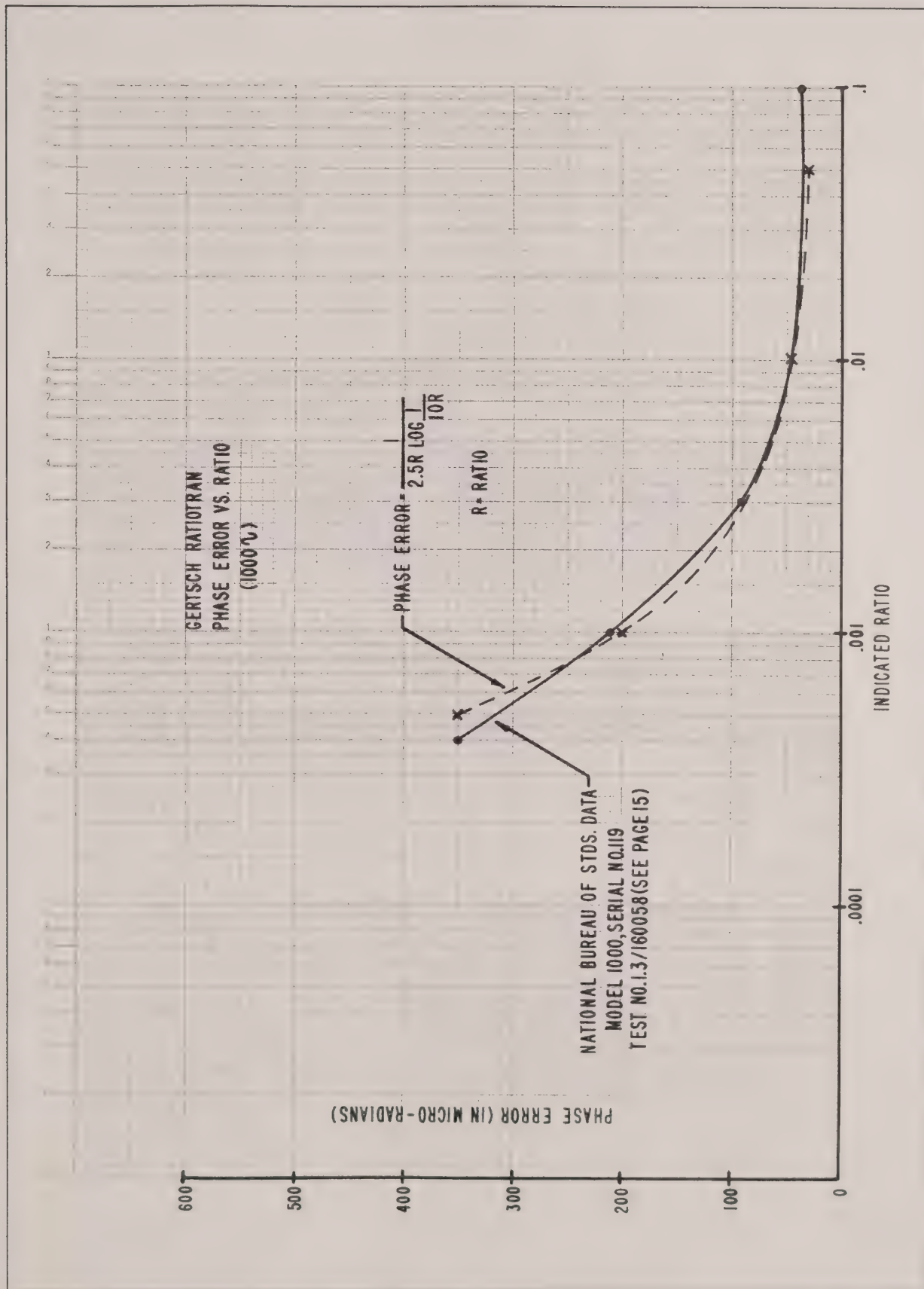


FIGURE 4. PHASE ERROR CURVE

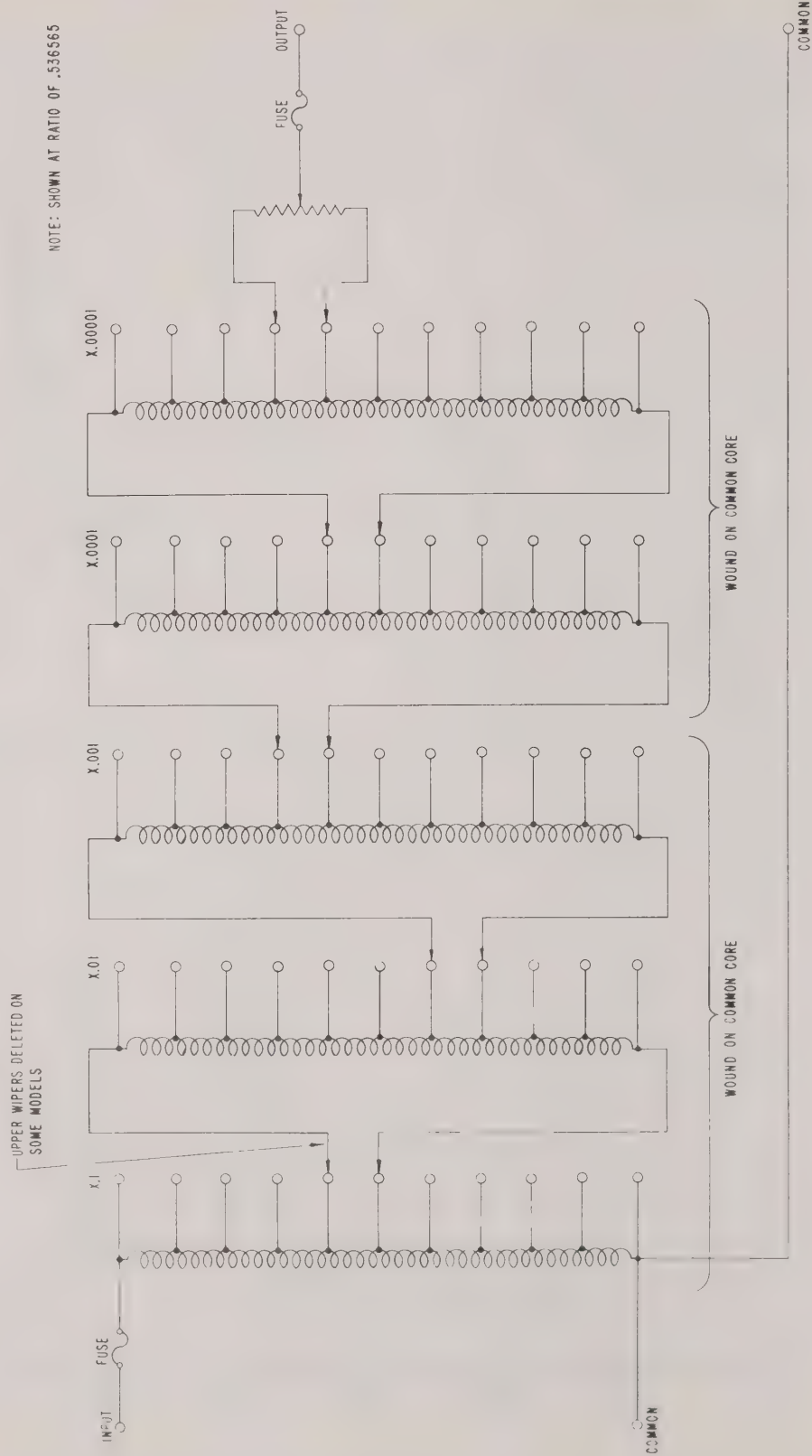


FIGURE 5. TYPICAL SCHEMATIC

NOTICE

The following reproduction of The National Bureau of Standards Certification of a Gertsch Model 1011AC Ratio Standard is included in this instruction book for purposes of information only.

U.S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS
WASHINGTON, D.C. 20234

REPORT OF CALIBRATION

INDUCTIVE VOLTAGE DIVIDER
Gertsch Model 1011, Serial No. 102

Submitted by

The Singer Company
Gertsch Department
3211 South La Cienega Blvd.
Los Angeles, California 90016

This divider was tested at an ambient temperature of 22°C, using alternating voltage of practically sine-wave form. Connections were made to the terminals located on the front panel, and the "FUSE" switch was in the "OUT" position.

<u>Dial Setting</u> (D)	<u>Frequency</u> (Hertz)	<u>Input</u> <u>Volts</u>	<u>Output</u> <u>Burden</u>	<u>Voltage</u> <u>Ratio</u>	<u>Phase Angle</u> (Microradians)
1.000 000 0	1000	100	No Load	0.999 999 ₉	-1
.900 000 0				0.900 000 ₂	-3
.800 000 0				0.800 000 ₁	-5
.700 000 0				0.700 000 ₀	-10
.600 000 0				0.599 999 ₉	-8
.500 000 0				0.499 999 ₉	-5
.400 000 0				0.399 999 ₇	+1
.300 000 0				0.299 999 ₆	+9
.200 000 0				0.199 999 ₆	+20
.100 000 0				0.099 999 ₈	+33

211.06/195516

The Singer Company
 Inductive Voltage Divider
 Gertsch Model 1011, Serial No. 102

-2-

<u>Dial Setting</u> (D)	<u>Frequency</u> (Hertz)	<u>Input</u> <u>Volts</u>	<u>Output</u> <u>Burden</u>	<u>Voltage</u> <u>Ratio</u>	<u>Phase Angle</u> (Microradians)
.0X0 000 0	1000	100	No Load	0.099 999 8	+20
.090 000 0				0.089 999 7	+20
.080 000 0				0.079 999 7	+19
.070 000 0				0.069 999 7	+20
.060 000 0				0.059 999 8	+22
.050 000 0				0.049 999 8	+26
.040 000 0				0.039 999 9	+26
.030 000 0				0.029 999 9	+28
.020 000 0				0.019 999 9	+32
.010 000 0				0.010 000 0	+40
.00X 000 0				0.010 000 0	+28
.009 000 0				0.009 000 0	+30
.008 000 0				0.008 000 0	+32
.007 000 0				0.007 000 0	+32
.006 000 0				0.006 000 0	+37
.005 000 0				0.005 000 0	+44
.004 000 0				0.003 999 9	+32
.003 000 0				0.002 999 9	+43
.002 000 0				0.001 999 9	+64
.001 000 0				0.001 000 0	+140
.000 X00 0				0.001 000 0	+140
.700 143 6				0.700 143 7	-11
.100 254 3				0.100 254 1	+33

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<u>Dial Setting</u> (D)	<u>Frequency</u> (Hertz)	<u>Input</u> <u>Volts</u>	<u>Output</u> <u>Burden</u>	<u>Voltage</u> <u>Ratio</u>	<u>Phase Angle</u> (Microradians)
1.000 000 0	400	100	No Load	0.999 999 ₉	0
.900 000 0				0.900 000 ₁	-2
.800 000 0				0.800 000 ₁	-3
.700 000 0				0.699 999 ₉	-4
.600 000 0				0.599 999 ₉	-4
.500 000 0				0.499 999 ₉	-2
.400 000 0				0.399 999 ₈	0
.300 000 0				0.299 999 ₈	+4
.200 000 0				0.199 999 ₉	+8
.100 000 0				0.099 999 ₉	+12
.0X0 000 0				0.099 999 ₈	+11
.090 000 0				0.089 999 ₈	+12
.080 000 0				0.079 999 ₈	+11
.070 000 0				0.069 999 ₈	+11
.060 000 0				0.059 999 ₈	+12
.050 000 0				0.049 999 ₉	+13
.040 000 0				0.039 999 ₉	+13
.030 000 0				0.030 000 ₀	+12
.020 000 0				0.020 000 ₀	+14
.010 000 0				0.010 000 ₀	+16

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<u>Dial Setting</u> (D)	<u>Frequency</u> (Hertz)	<u>Input</u> <u>Volts</u>	<u>Output</u> <u>Burden</u>	<u>Voltage</u> <u>Ratio</u>	<u>Phase Angle</u> (Microradians)
.00X 000 0	400	100	No Load	0.010 000 0	+14
.009 000 0				0.009 000 0	+14
.008 000 0				0.008 000 0	+15
.007 000 0				0.007 000 0	+15
.006 000 0				0.006 000 0	+17
.005 000 0				0.005 000 0	+17
.004 000 0				0.003 999 9	+8
.003 000 0				0.002 999 9	+11
.002 000 0				0.001 999 9	+12
.001 000 0				0.001 000 0	+26
.000 X00 0				0.001 000 0	+27
.800 195 6				0.800 195 7	-3
.100 823 4				0.100 823 2	+12

For other settings, corrections deduced from the above table are not strictly additive. However, they may be assumed to reasonably represent the errors in the performance of this divider.

The voltage ratios given in this report are the ratios of the "OUTPUT" terminal voltage to the "INPUT" terminal voltage, with the case connected to the terminal marked "COM".

The phase angle is the angle between the input voltage and the output voltage phasors. A plus (+) sign indicates that the output voltage phasor leads the input voltage phasor.

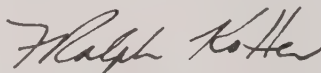
The voltage ratios and phase angles given in this report apply to the fundamental components of the voltages and are considered accurate at the time of the test and under the stated test conditions within 5 steps on

The Singer Company
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Gertsch Model 1011, Serial No. 102

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the 10^{-7} decade and $5\sqrt{D}$ microradians, respectively. Moreover, on the basis of our experience with dividers of this type, we believe the values for voltage ratio may be considered reliable to an accuracy of 1 step on the 10^{-6} decade for a period of at least three years, provided the divider is kept in a normal laboratory environment, has clean, low-resistance switch contacts and does not suffer injury or insulation damage.

For the Director
by



F. Ralph Kotter, Chief
High Voltage Section
Electricity Division
Institute for Basic Standards

Test No: 211.06/195516
Order No: G02627
Date: May 29, 1968

ADDENDUM #1 TO RT MANUAL # 1 - 500783-089

The RatioTrans Instruction Manual gives general information on the Model 1000.

However, the table titled "Replacement Parts for Ratio Standards" (Page 10) should be deleted and replaced by Table 1, below.

The component parts list, Table 2A below, should also be added to the RatioTrans manual.

Federal Supply Codes are given in Table 2B.

The schematic diagram for Model 1000 is given in general form in the RatioTran manual.

For detailed schematic, see Drawing Number 4-500940-001.

TABLE 1
MODEL 1000 PROVISIONING LIST

REF DES	DESCRIPTION	SINGER REF. NO.	MFR P/N	QTY/ UNIT	SPARES 1Yr. 5Yr.	
S1	Switch	2-000370-001	Singer	1	1	3
S2, S3, S4, S5, S6	Switch	2-000371-001	Singer	5	5	15
T2	Trans Assy. LF 1st	4-001750-001	Singer	1		3
T4	Trans Assy. LF 2nd	3-001761-001	Singer	1		3
T1	Trans Assy. HF 1st	3-001760-001	Singer	1		3
T3	Trans Assy. HF 2nd	3-001751-001	Singer	1		3
F1, F2	Fuse	1-924000-022	Bussman MDL 1 1/2	2	10	30
	Knob, bar	1-102901-001	Singer	6	3	20



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GERTSCH DEPARTMENT
LOS ANGELES CALIF. U.S.A.

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TABLE 2A
MODEL 1000 COMPONENTS PARTS LIST

REF. DES	DESCRIPTION	SINGER REF. NO.	MFR	MFR P/N	QTY.
T2	Transformer Assy LF 1st	4-001750-001	Singer		1
T4	Transformer Assy LF 2nd	3-001761-001	Singer		1
T1	Transformer Assy HF 1st	3-001760-001	Singer		1
T3	Transformer Assy HF 2nd	3-001751-001	Singer		1
	Dial Assembly	2-001623-001	Singer		6
	Knob, Bar	1-102901-001	Singer		6
J5, J7, J13, J15, J17, J20	Binding Post	1-941001-001	Grayhill	29-3	6
J6, J8, J14, J16, J18, J19, J21	Binding Post	1-941001-002	Grayhill	29-3	7
F1, F2	Fuse	1-924000-022	Bussman	MDL 1 1/2	2
	Post-Fuse	1-924003-002	Singer		2
S1	Switch	2-000370-001	Singer		1
S2, S3, S4, S5, S6	Switch	2-000371-001	Singer		5
	Handle		Usecor	1030-13-550	2
R1-R22	Resistor, 1/4w, 10%, 2.2K	1-945000-041	Allen Bradley	CB	22
R23-R130	Resistor, 1/4w, 10%, 47	1-945000-021	Allen Bradley	CB	108



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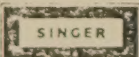
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TABLE 2B

FEDERAL SUPPLY CODES

GRAYHILL	81073
BUSSMAN	71400
USECO	15849
SINGER	88869



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